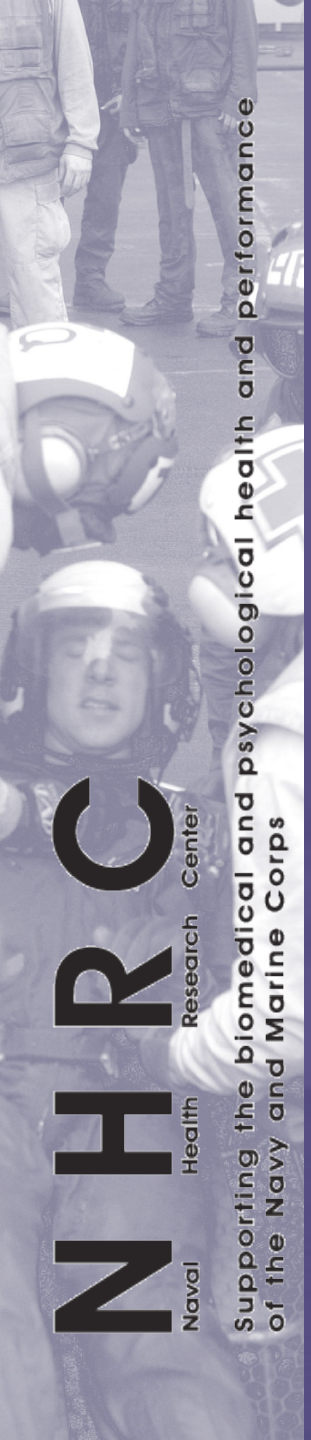
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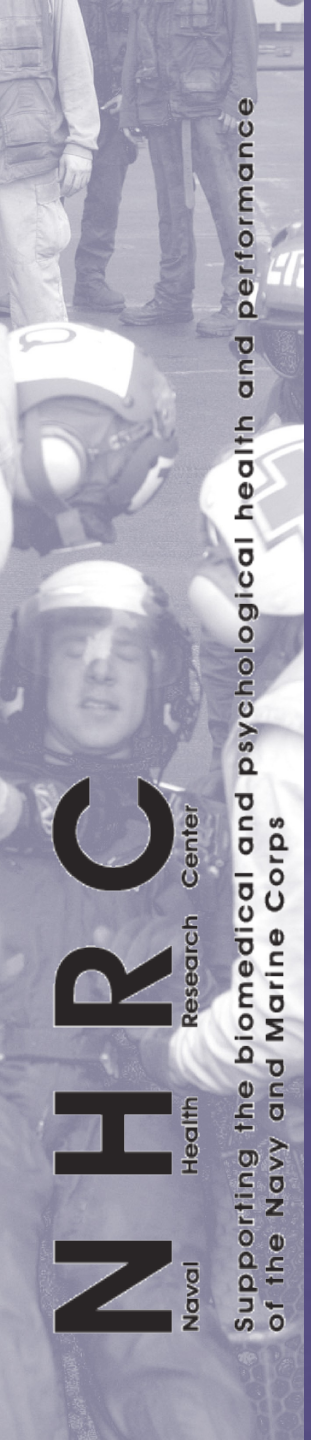
# Impact and Injury in Special Operations Craft

Fleet Review
04 December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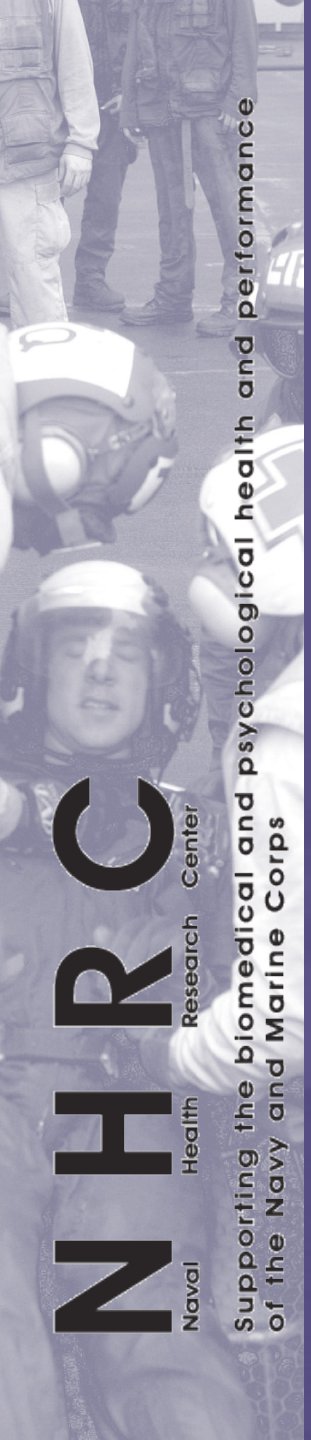
# Sponsors

- Office of Naval Research
- U.S. Special Operations Command
- U.S. Army Medical Research and Materiel Command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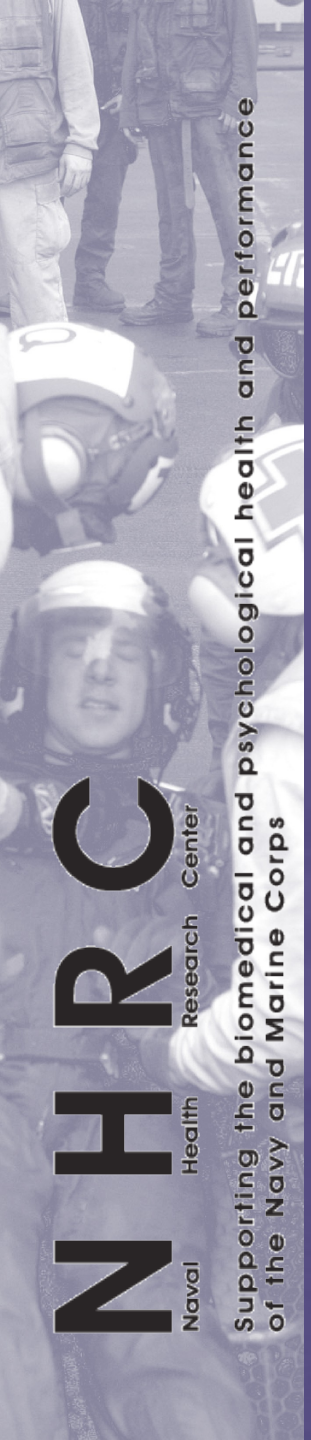
# Background

- **Boat operators & crew subjected to severe boat-wave impacts**
- **Can result in injuries, fatigue, extreme discomfort and pain**
- **Can shorten the working life of these highly-trained personnel**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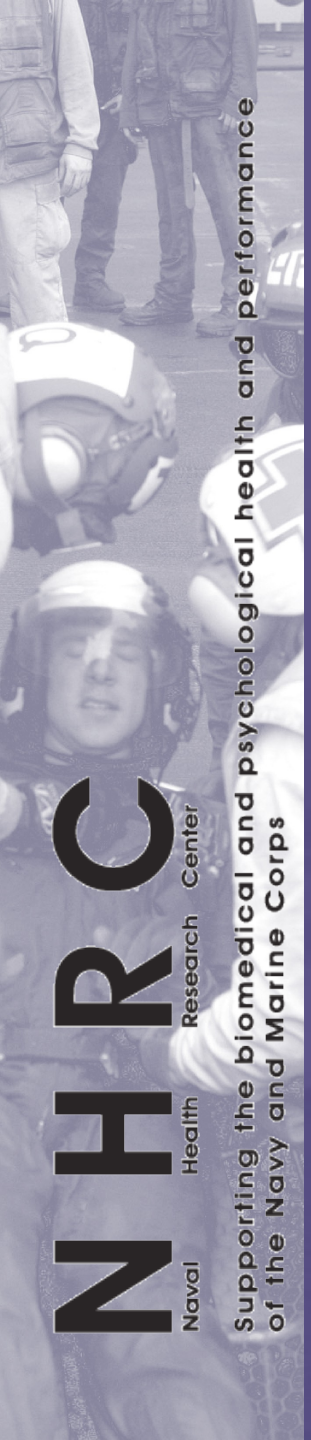
# Background (cont'd)

- Recent study finds 65% of those surveyed reported one or more injuries
- 95% of injuries attributed to Special Boat operations
- Highest hospitalization incidence for these reported injuries among rated personnel
  - Special Boat operators: 2,687/100,000 person-years
  - Navy average: 479/100,000 person-years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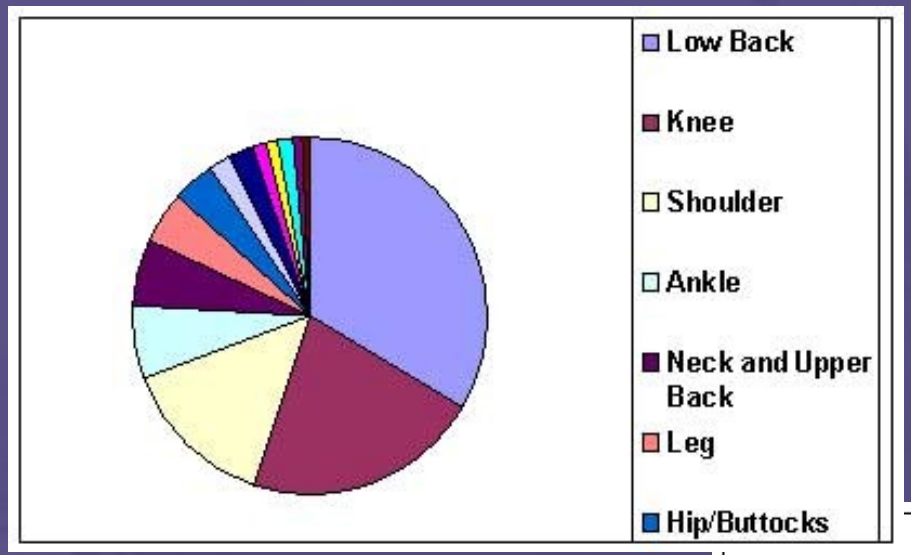
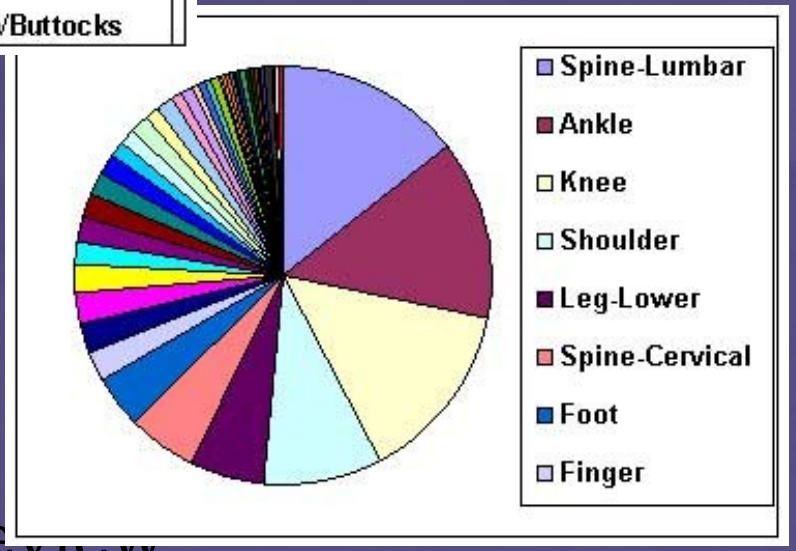
# Background (cont'd)

- **Most common injuries**
  - **Sprains & strains (49.35)**
  - **Disc problems,**
    **Other trauma (7.9% each)**

# Anatomical Distribution of Injuries

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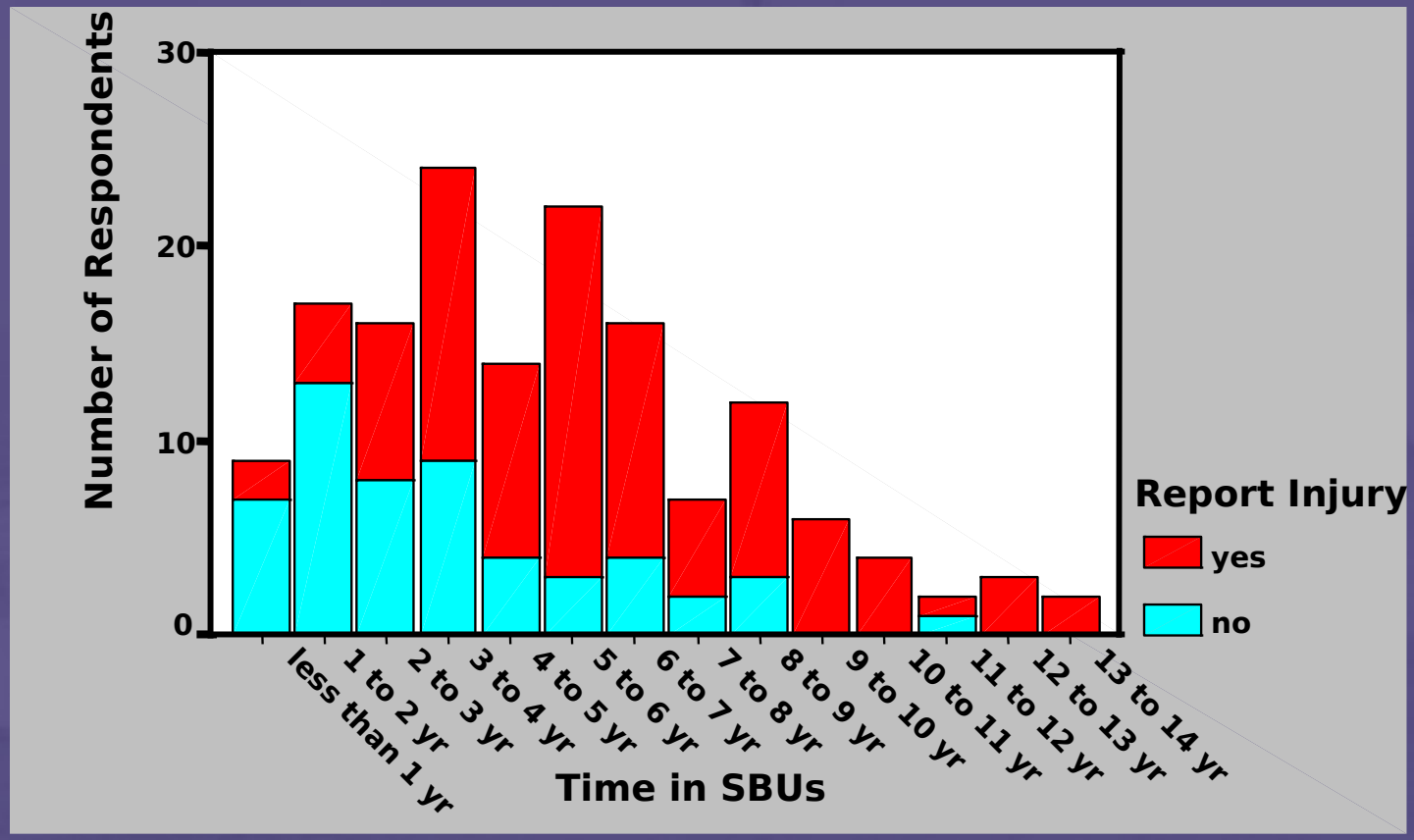
# Distribution of Injury Status by Time in SBU

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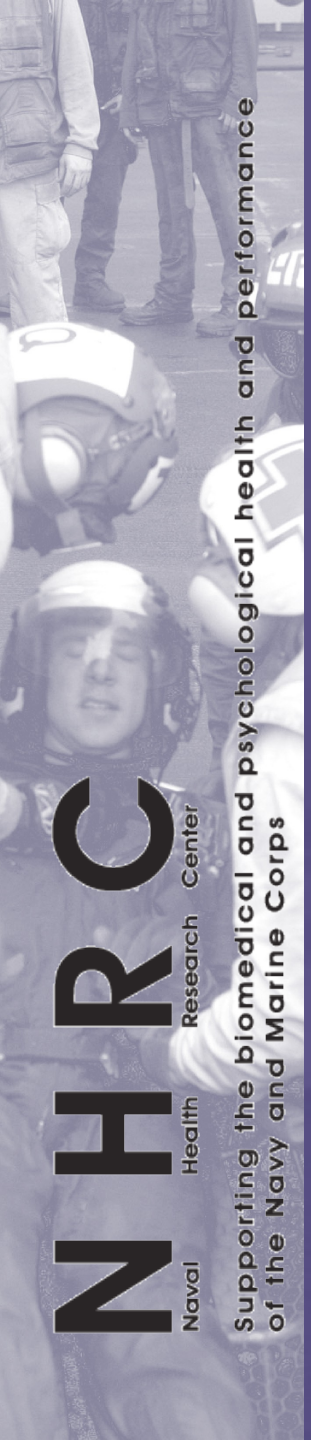

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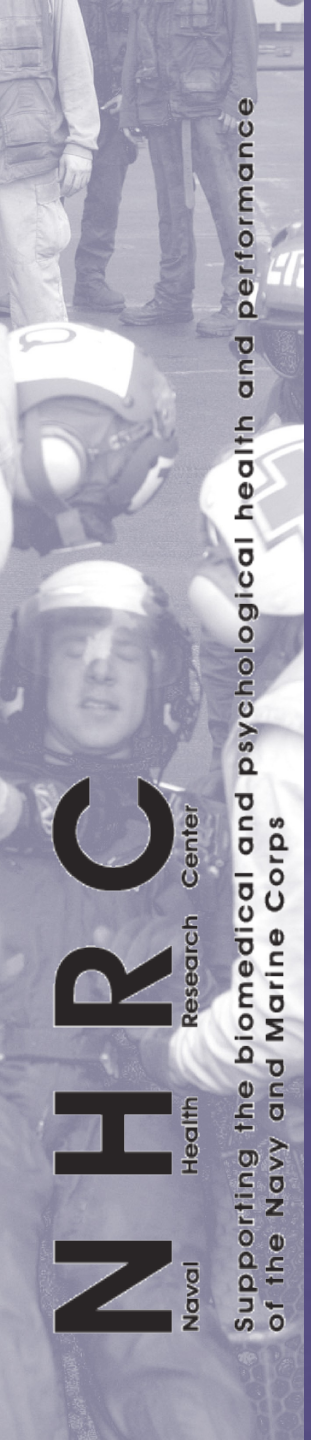
# OBJECTIVES:

- **Reduce the rate of mission-related injury among Special Warfare Combatant-craft Crewmen (SWCC)**
- **Assist SOCOM in the Test and Evaluation of new shock mitigation technologies**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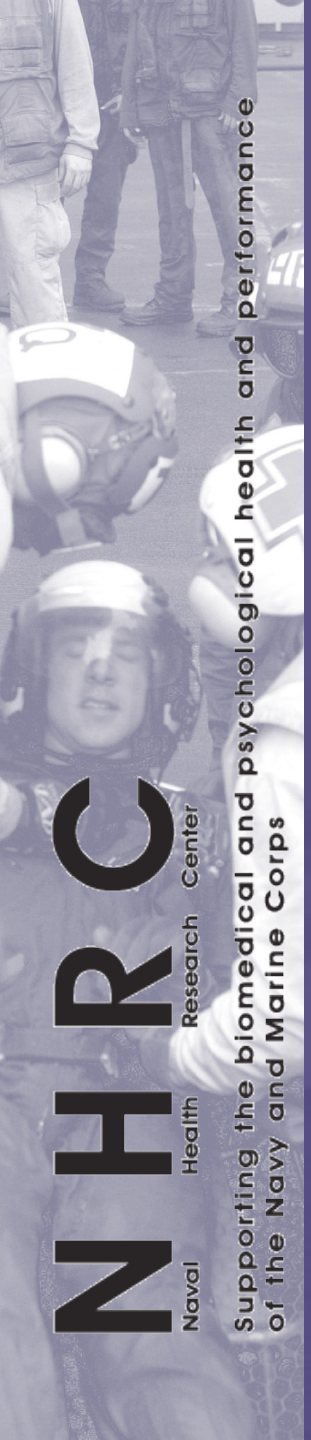
# APPROACH:

- **Develop models to predict injury**
  - **Correlational models**
    - **Based on associations between impact exposure data, and physiological damage indicators, and musculoskeletal symptom reports**
    - **Focused exposure studies**
  - **Epidemiological models**
    - **Physical attributes, exposure and injury**
    - **Longitudinal studies**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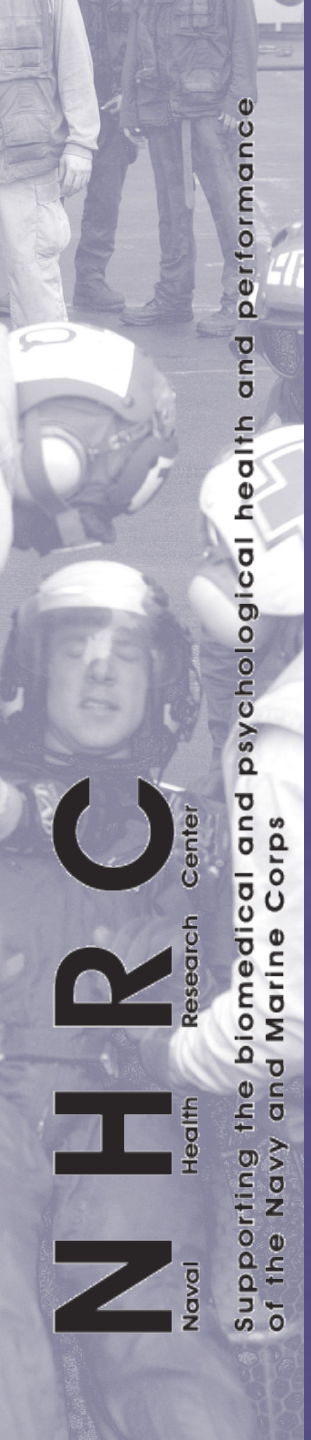
# Application

- **Development of exposure guidelines**
  - **Optimize operational schedules**
- **Development of engineering standards**
  - **Evaluation of new shock-mitigation strategies**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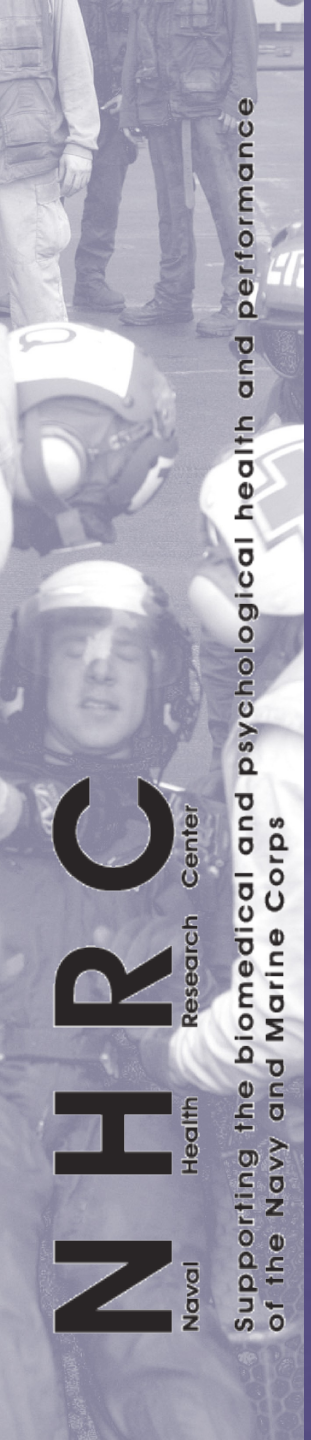
# Progress

- Developed systems to record impact accelerations in 6 degrees of freedom.
  - Boat and human dynamics
- Assisted SOCOM in the testing and evaluation of shock mounted seats for use on the Mk. V patrol craft.
- Evaluated physiological response to an open-ocean transit.
- Developed measures for longitudinal studies



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# NSWC, Panama City Data Acquisition System

## CONTROL BOX

- Receives GPS data (for time stamp
- Compares craft speed to pre-set va
- When threshold exceeded, unit ser
  - On/off signal & time to datalogge
  - On-off signal & time to VCRs (via
- Unit is compact, ruggedized, water and self-powered

## DATA LOGGERS

- Sensor packs for human dynamics & EMG
  - 3-axis MEMS accelerometers
  - 3-axis MEMS angular rate sensors
  - 2 Open channels
- Each 8-ch datalogger is 3/4 x 7 x 4 in
- Loggers are rugged, compact, untethered,

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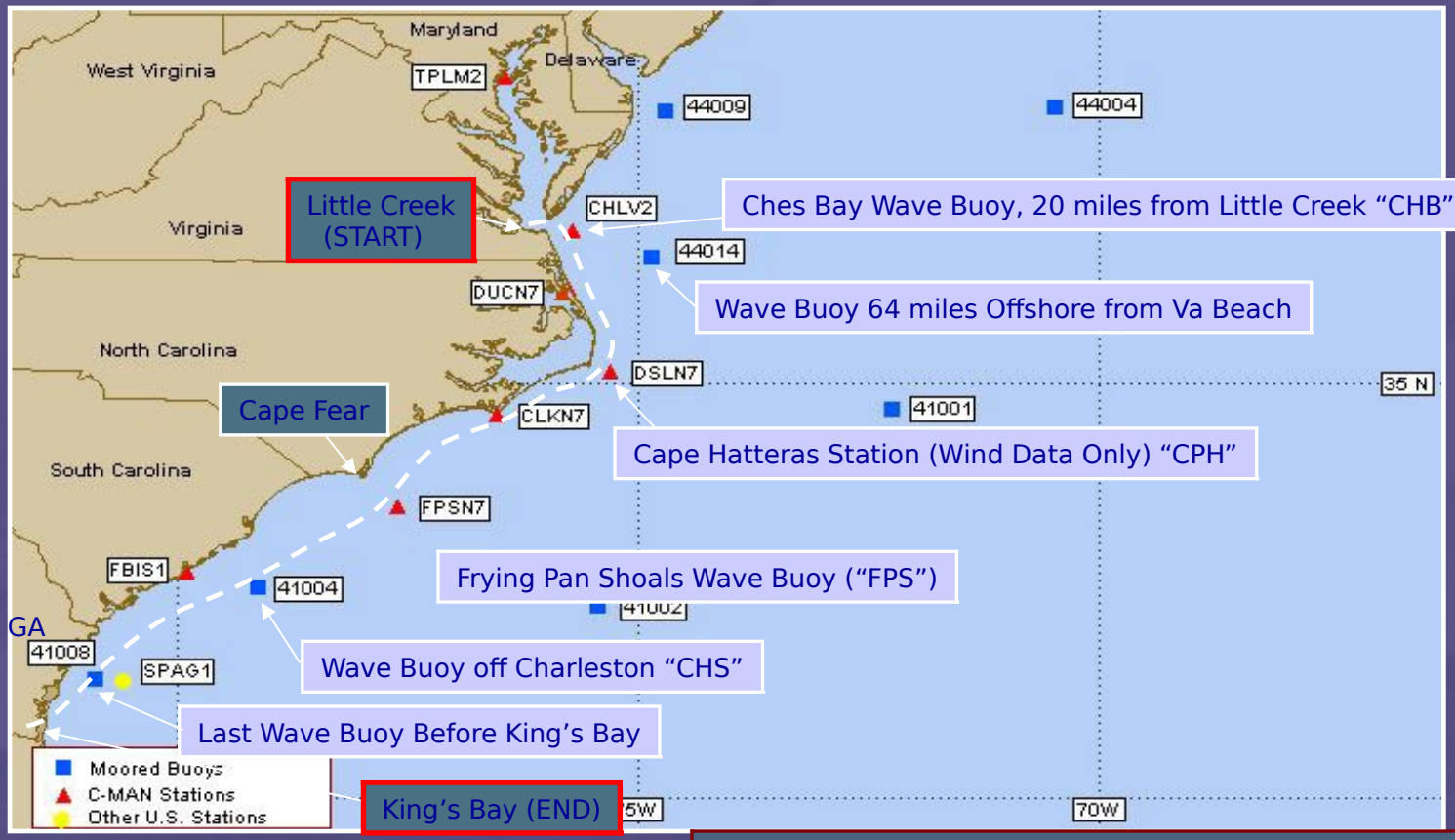
# Transit Study




**Day 1, LC to CF: 13.5 hr Seas 5-6 ft**
**Day 2, CF to KB: 9.0 hr Seas 3-4 ft**

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# Significant Findings

- **Above normal limits**
  - **Inflammatory processes**
    - **Serum Interleukin-1β**
    - **Serum Interleukin-6**
  - **Connective tissue turnover**
    - **Urinary Pyridinoline/Creatinine**
    - **Serum Osteocalcin**
  - **Blood in the urine**
    - **Urinary Free and Total Hemoglobin**



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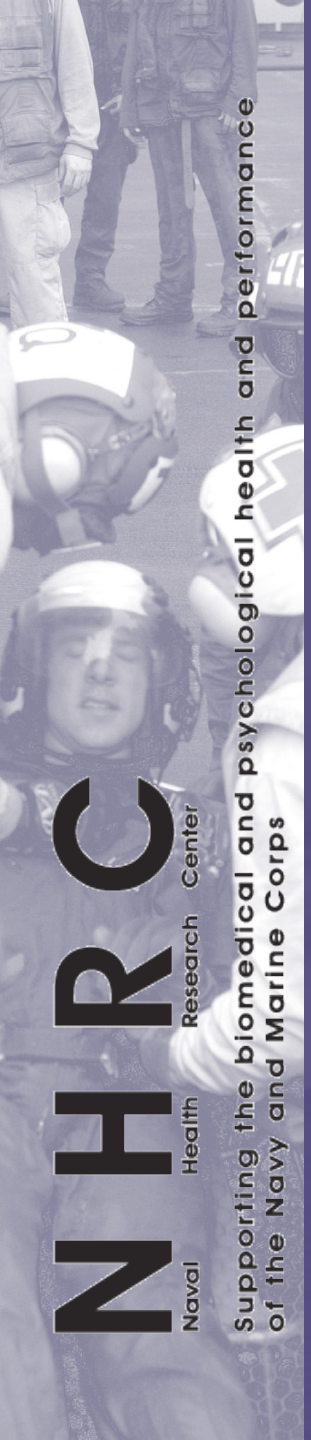
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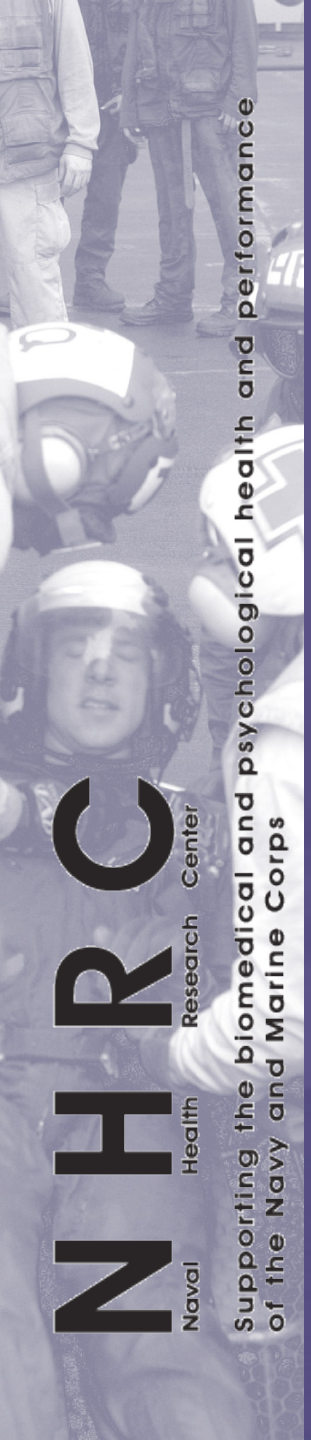
# Significant Findings

- **Time effects**
  - **Connective tissue turnover**
- **Differences from Control**
  - **Inflammatory processes**
  - **Connective tissue turnover**
  - **Catabolic state**
    - **Serum Cortisol**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# Status

- **Panel of biomedical markers sensitive to processes invoked by impact exposure.**

# Physical Evaluation

- **Functional Range of Motion movement tasks**
  - **Stooping reach with 36” horizontal displacement**
  - **Overhead reach with axial rotation**
  - **Kneeling reach to standing reach**

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# Physical Evaluation (cont'd)

- **Dual-energy X-ray Absorptiometer (DXA) assessment of bone health**
  - **Bone density measurement of vertebrae and femoral neck**
  - **Measurement of vertebra shape and spacing from lateral scans**

- **Leg strength/power measurement**
  - **10-sec Isometric leg presses**

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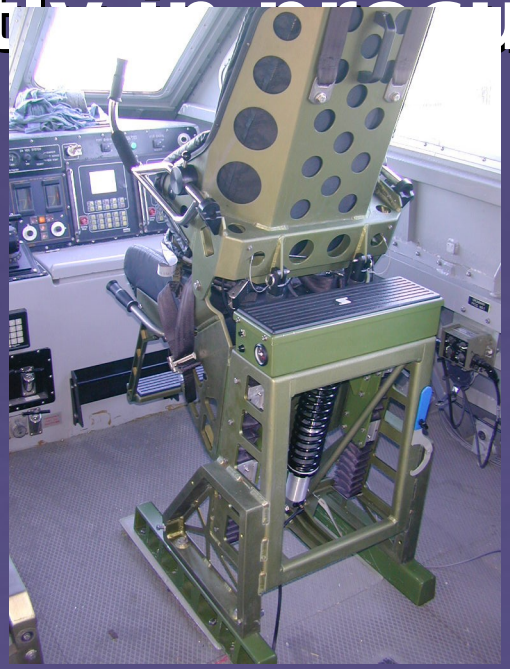
# Product

- Development of shock-mounted seats for the Mk. V patrol craft.
- Currently in procurement.



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